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ABSTRACT

This paper suggests ways that coordination between two-year colleges and baccaluareate institutions can be improved and the opportunities for successful student transfer can be enhanced, with particular reference to the mathematics curriculum and the role of mathematics instructors at two- and four-year institutions. After discussing the differences between formal coordination and informal communication, the paper highlights the potential role of professional math societies in disseminating results of formal study projects and encouraging members to follow their recommendations. Next, the role of informal communication channels in improving the prospects of coordination between two- and four-year institutions is outlined, and the importance of sharing materials and methods is stressed. Then, the paper considers ways of encouraging administrator responsiveness to program development and change. After warning of pitfalls to avoid in establishing communication between two- and four-year institutions, such as the involvement of the four-year institution in the internal problems of the two-year college, the paper highlights some ways the receiving department at the four-year college can assist transfer, focusing on transcript evaluation, advising, and placement procedures. Concluding remarks emphasize the responsibility of two-year college faculty for ensuring that a passing grade means that the student is ready to transfer to the next level. (HB)

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Jerome A. Goldstein

Paper presented at the Sloan Foundation Conference on
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Coordinating Curriculum in Two-Year Colleges with Baccalaureate Institutions

Bettye Anne Case and Jerome A. Goldstein

ABSTRACT

The success of transfer students from two-year colleges to baccalaureate institutions depends on a number of factors. Topics discussed here include policy and administrative matters, possible roles of professional societies, and baccalaureate institution responsibility after transfer. The main emphasis involves the important roles played by individual faculty members at both types of schools.

1. Introductory Remarks

Coordination leading to successful student transfer experiences from the two-year college to the baccalaureate institution inherently involves policy and administrative as well as curricular matters. Many of these are beyond the ability of individual faculty to influence although we will discuss a few possibilities later. First, though, let us concentrate on coordination involving faculty primarily, distinguishing between formal coordination and local communication. Most of the *evidence* presented here to support suggestions is anecdotal, but hopefully there will be some suggestions which in context ring true to the reader. We do not expect to say much not already *known* to the reader, who will, we hope, be reminded of some useful ideas.

This conference and the joint MAA-AMATYC Panel on the Two-Year College Curriculum [1] are formal but non-mandatory coordination efforts. Carrying a greater aura of authority is *The Curriculum Guide for Baccalaureate Oriented Courses in Mathematics* [2] prepared by the Junior College Task Force affiliated with the Illinois Section of the MAA. It lists minimal course content and was "printed by authority of the State of Illinois" and carries some authority despite the absence of any enforcement intent. And in states with common course numbering in state schools, specifying a minimal core of common topics in courses similarly numbered increases further the mandatory nature of *coordination*.

2. Role of Professional Societies

Professional societies do not appropriately decree uniformity and cannot mandate change. However, it is within the scope of the professional societies to encourage the voluntary following of recommendations made by formal study projects and to disseminate these recommendations widely within their membership and to appropriate administrators. It is helpful when publications specifically address the two-year college situation; two recent M.A.A. publications notable in this regard are the C.U.P.M. panel reports *Minimal Mathematical Competencies for College Graduates* [3] and *Mathematics Appreciation Courses* [4].

In approaching this particular problem, curriculum coordination between two-year colleges and baccalaureate institutions, more than one professional society is involved as the people who need to work on the problem belong to at least three different national groups. Because of earlier teaching at the high school level or involvement in affiliated state two-year college groups, many two-year college faculty are involved in NCTM (which does not confine itself to K-12 interests). Other two-year college faculty are members of MAA, AMATYC or state (but not national) groups. One suggestion that has been made by a two-year college member of the two-year curriculum panel, Sheldon Gordon, is that the two parent organizations, MAA and AMATYC, hold joint national meeetings. We quote from a recent letter written by Gordon [5]. "The growth in AMATYC and the state-wide two-year college math associations is a positive step. It promotes a feeling of identity and unity among these faculty members and, as such, provides the opportunity to interact with mathematicians at other institutions. It is undeniably a healthy development. On the other hand, it carries with it some drawbacks as well. In particular, might it not create a further ghetto attitude, separating the two-year college mathematician from his counterparts in the four year schools? In turn, won't this institutionalize the feelings of inferiority? I suspect that they will, unless the organizations themselves realize the implications and address them. For instance, just as the AMS and the MAA hold their national meetings jointly, might not it be desirable to have AMATYC do the same?"

Perhaps some of the ideas in this quotation are controversial, but any generated controversy should lead to healthy communication. Professional societies, by the very act of holding meetings drawing a diverse population with common interests, act as a catalyst for the communication between faculty at different types of schools. When this occurs between neighboring two-year and baccalaureate faculty, automatically the case at state or section level meetings, concrete progress can be made toward curriculum coordination. Mathematics program heads in two-year colleges reported increased participation in conferences and the reading of journals by their faculties in 1975-1980. This bodes well for the opportunity for communication. (Cf. [6].)

And this communication on a local level, between two-year faculty and the baccalaureate faculty at institutions to which their students will transfer, is helpful even without strong formal efforts at coordination; it can lead to fine tuning so that for some students there is practically no transfer shock. Before we continue with suggestions concerning local communication, let us describe one professional society activity which is not widespread and which can be helpful in local curriculum coordination. Actually, D. R. Lichtenberg has coerced us into a two minute commercial for what the officers of the Florida Section of the MAA seem to think is the best Florida export since orange juice. (See [7]. These officers will happily supply more information.) Half day or Saturday joint meetings of high school, two-year college, baccalaureate institution faculties and other mathematics educators in geographic regions of radius under a hundred miles are organized under the auspices of the Section. These not only facilitate communication but often result in the two-year faculty gravitating to the central

role in planning. In Florida this has encouraged somewhat more two-year faculty participation in the larger Section scene and considerably more respect for two-year college faculty by baccalaureate faculty, and vice versa. The real payoff is in improved articulation between high schools and colleges and between two-year colleges and baccalaureate programs in the region. Mathematical and result in the two-year faculty gravitating to the central pedagogical talks by participants from all schools, films and a formal articulation session for information sharing are valuable, but conversations over coffee or at dinner lead to a mutual respect which cannot exist outside personal acquaintance.

This Florida effort seems to be precisely the sort of thing, one perhaps a less formal scale, called for in the recent conference *New Goals for Mathematical Sciences Education*, sponsored by C.B.M.S.: "The conference recommends the establishment of a nationwide collection of local teacher support networks to link teachers with their colleagues at every level..."[8].

3. Informal Communication Channels

There are frequently no official channels for the exchange of curriculum and program information. Early informatin about prospective changes is invaluable. Our advice is: grab the telephone and make a serious effort to establish meaningful contact with sympathetic colleagues who could be helpful. Official channels may not be as useful as informal individual contacts. Mutual respect is likely to be established more quickly through informal contacts. Additionally, such contacts have another obvious advantage over contacts through official channels, namely, they can give indications of the directions and likelihood of possible changes.

Long before revised entry requirements for a program are approved by a university governing board, they are debated and refined by the faculty of that program, often as a matter of public record and rarely with ethical need for secrecy. Early explanation of what *may* happen from baccalaureate to two-year faculty colleagues could result in informal advice to two-year students which is invaluable. Baccalaureate faculty may hesitate to pass along the need for changes because they want to avoid looking dictatorial. But nevertheless they can ask two-year faculty about courses and texts, and they can offer information valuable to transfers or those preparing them to transfer. Such information may not be in print.

Two-year faculty can and must similarly instigate communication and must not be put off if the first person contacted, possibly a busy department chair, is not very responsive. *Some* faculty member at the baccalaureate institution does care about the mutual problem of transfer articulation, knows it cannot be successful without curriculum coordination, and is eager to work with two-year colleagues. We reaffirm our earlier advice: keep inquiring.

Once communication is established between individual faculty or administrators in neighboring mathematics departments, the obvious next step is a sharing of materials and methods. Syllabi, information provided to new instructors, flow charts showing sequences of topics within or between courses, and discussion of optional topics, will productively move in both directions. Baccalaureate faculty may be surprised to find sophisticated educational research or curriculum projects being carried out by two-year college faculty and can often benefit from their results.

One university, faced for the first time with teaching non-credit remedial courses and the further requirement that they contain certain specified *minimal skills* to be tested on a state-wide basis, made prompt (and thankful) use of the careful matrix of skills vs candidate texts made up by the local community college. In the other direction, a university statistics department teaching a two-semester service sequence, the first semester of which could be taken at the local community college, shared their exhaustive text analyses and the reasons for their rankings with the two-year faculty member, not a statistics specialist, teaching the course [6]. The two-year college adopted the same text and the instructor was careful not only to cover *Chapters 1 to n* but to begin the subject matter of *Chapter n + 1* and to review carefully concepts and techniques to be used in the sequel. The word quickly got out that students should be sure to get Statistics I at that two-year college because those who did made better grades in Statistics II [9].

We do not wish to imply that the same texts or methods must be adopted if articulation is to be successful. Another situation where there was communication led to different text selection but an interesting set of byproducts [5]. A two-year college faculty member who often taught the calculus sequence also taught an occasional night course at a nearby university as an adjunct instructor. Since he was known to some of the members of a committee revising the university calculus sequence, he was invited to sit on the committee. Despite some initial misgivings on both sides, he participated as a full committee member over several months of regular meetings and gave detailed and specific input. As it turned out the

committee rejected for the university all those texts which omitted certain topics of the third semester of the sequence. The two-year participant felt the resulting choice was optimal at the university and voted for it but felt that a text rejected earlier had more examples and more careful explanation in its early chapters. When he explained the situation to his two-year colleagues, their decision was adoption of the text which had been rejected early at the university, reasoning that since there were relatively few students enrolling in Calculus III at their college, supplementing the text was a lesser problem than dealing with a less "user friendly" beginning. The real winners of this situation were the students transferring between these institutions.

4. Encouraging Administrative Responsiveness

There are limits to what can be achieved by individual communication or even department to department communication. Sooner or later there is the *administrative hurdle*. When it is a matter of the inability of two-year faculty to get an approval of a program change or such, patient explanation and a united front of the two-year department faculty will likely be successful. From the reports of former students, articulation success is at least anecdotally verifiable and administrators are susceptible to pressure to facilitate improvement. (We wish it were possible to loosen up travel money or lighten teaching loads for two-year faculty by just explaining the benefits!) Several MAA sections having articulation sessions at their meetings which are advertised under state auspices (or are publicized through notification of *academic deans* in addition to *department chairs*). These have been successful in expected ways

as well as in unexpected ways. Namely, they have led to the availability of additional travel funds and, in the case of Illinois [10], have resulted in improved relationships with administrators.

It is generally felt that two-year colleges are relatively more responsive to community pressure and less tied to tradition than baccalaureate institutions. This very responsiveness points up the necessity for short-range communication. Interaction with nearby universities can affect two year college curriculum adaptation more than national studies. For example, a current report on the status of discrete mathematics in two year colleges might conclude that few but large departments with depth in teaching resources offer discrete mathematics courses. But suppose that a two year college has a significant number of students per year intending to transfer into the computer science or mathematics curriculum at a nearby university teaching discrete mathematics to freshmen and sophomores and requiring it for all programming courses. If there are enough such students to run a small class, then *depth and resources* just may be found. While two-year faculty must keep aware of the big scene and national trends, change often cannot be made by two-year colleges in advance of implementation at the baccalaureate institution.

Students sometimes transfer, for academic or financial reasons, from a baccalaureate institution to a two-year college. Since these *reverse articulation* problems are not very common they probably do not need addressing but an anecdote about one may be worthwhile. A two-year college business calculus instructor had found that students who transferred from the nearby university between precalculus and calculus, although having studied from the same text, had covered one chapter less. Since these particular students were

not academically strong anyway, this was a difficult problem. Discussing this with the associate chair of the mathematics department at the university, they agreed that the breaking point between the courses at the two-year college was more logical, and that the appropriate university committee would take it up. But, despite their personal agreement, there would be no change soon, although he commiserated with her [11]: "You people must sometimes feel like you're in bed with an elephant."

5. Caveats

Although certain caveats in communication between two-year and baccalaureate faculty may seem obvious though preachy, and others may be debatable, we cite a few for the sake of dialogue. It is best that baccalaureate program faculty not get involved or even state opinions about two-year college internal problems such as (1) department structure or power struggles, (2) conflicts between those two-year college faculty with allegiances to different professional organizations, or (3) discussion over which courses should be credit bearing at the two-year college. (This latter is not really a problem for the baccalaureate program standards because major requirements and admission entry levels can take care of it.) Baccalaureate faculty must not be didactic or proprietary about the absoluteness of the upper division status of a course. (It probably is, after all, taught to freshmen at some schools so such arguments will probably look foolish as well as selfish or bossy.) It is important not to state opinions which could possibly be construed as trying to dictate which *boundary* courses be left for the baccalaureate institution and certainly never be judgmental about *what the two-year college can teach 'right'*. For example, if the first

programming course for engineers at the baccalaureate institution uses Pascal and the two-year college still uses FORTRAN, that fact should be made known to the two-year faculty. Lack of action on that information does not mean disregard of advice or callousness to student needs. The two-year college computer system may not have a Pascal compiler, or students transferring in greater numbers to another baccalaureate institution may need FORTRAN. Two-year faculty should not assume Ph.D. research mathematicians do not care about quality teaching. In addition to cooling the chances of possible cooperative actions quickly, it also sometimes leads to failure of the two-year college to hire Ph.D. holders when they are available in a job applicant pool. Further they should not assume two-year faculty are not welcome at seminars, colloquia, and meeting sessions on mathematical topics. No one but the specialist understands all of the typical mathematical talk, and the two-year college faculty member whose interest is piqued by a topic is always welcome.

Of course neither should assume that there is a universal best way to do things. And neither should be too inventive or too quick to make changes which will affect articulation. In particular, credit courses should not be restructured so as to handicap students who transfer in the middle of course sequences. The very nature of the two-year college student body and the higher percentage of late bloomers there guarantees that at whatever point in mathematical training a student *can* transfer, some student *will*. Innovative restructuring leading to long sequences of courses needed intact will probably hurt some students so badly that its value is questionable.

6. Baccalaureate Department Responsibility after Transfer Occurs

This leads us to consider what can be done to ease two-year college baccalaureate institution articulation problems after the student transfers. Most of these are functions of the baccalaureate institution administration and faculty but one at least is a two-year college function: supplying information requested for transcript evaluation. The two-year college administrations are sometimes less than quick in responding to such requests for the statistically unusual student who insists on transferring from Michigan to Miami. If the request for information on a particular course reaches a two-year college mathematics department, an appropriate response would be the *immediate* dispatch of either a syllabus outline of topics with approximate time spent or, if the course was taught entirely from a standard text, a copy of the title page and table of contents with the covered portions marked. Often the administrative offices just send the same catalogue description that the baccalaureate institution had already found insufficient for evaluation.

The baccalaureate institution administration is responsible for transcript evaluation, advising, and placement procedures but will often respond to suggestions for improvements. Some flexibility to move students *back* (or forward) to another course at some early point is perceived in the sequel as ideal but rare. There is rarely any *grace period* for adjustment to the new college by transfers as is typically allowed for first time college students. Transfers with bad grades in their first semester are often not invited back. The only safeguard often is that they receive careful individually considered advice and that placement err if at all on the conservative side. While acknowledging that some students from two-year

colleges just will not be able to make the transition, it is only humane to prevent instant and perhaps unnecessary washouts.

One incentive to voluntary curriculum coordination may be avoiding the big stick technique of the Florida legislature. Although it primarily benefits students the articulation agreement legislated between the public two-year and baccalaureate schools in that state can slow necessary change and stifle incentive to innovate.

A minimal fall-back position for a baccalaureate faculty member or department desiring an improved transfer success rate is to be very careful that individual advisees are properly placed. Even with the best of intentions and with information about previous courses, very hard questions remain. What does one do about the mid-sequence student with Calculus I credit but neither the integration applications or techniques material that the baccalaureate school teaches in Calculus I? What about the student transferring in with a computational linear algebra course when the local course is a heavily proof oriented preparation for modern algebra and advanced calculus? In some of these cases, auditing the earlier course is the best advice for an average student. However, considerable time and explanation must be spent with students before they can accept this recommendation and not regard it as a *put down* of their earlier training.

Individual faculty can, through the classroom, improve the transfer success rate. Four specifics which do not take a great deal of effort or involve actual course slowdown and which benefit all students are: 1) Giving transfer students and others desiring it a copy of the preceding course syllabus. (This will prompt some "I never had..." comments

from adequately prepared students but will warn those deliberately or accidentally overplaced.) 2) A *review* assignment with considerable specificity can be made for the first weekend of the course and can include minimal aspects of the prerequisite material. 3) A *makeup* lecture or two or an arrangement with the Math Lal or tutoring service to provide this may be possible. (And, somehow, the students needing this early intensive work must be identified and persuaded to take advantage of these first three assistance devices.) 4) It must be remembered that having transfers requires extreme care to re-teach earlier concepts when they are needed, especially such concepts as are known to be not well understood.

7. Conclusions

While the baccalaureate faculty must bear much responsibility for realistic placement and assistance in adjusting, the two-year faculty must be certain that the student passed with a "C" is ready for transfer at *some* level. It does not matter greatly in the long run whether the student gets through course p or p + 1 at the two-year college, but there is a problem if each course is less demanding than its counterpart or is inadequate preparation for the next logical course placement at the baccalaureate institution. The often repeated motto of many open admissions school faculty: "Our school may be easy to enter, but our students are worth something if they graduate", should be borne in mind with respect to the courses in the baccalaureate track mathematics offerings of the two-year college.

The desire by both institutions that students be successful is the strongest pull toward working out articulation problems, and that pull may be strongest on the two-year college. Tenacity on the part of the two-year

faculty to obtain the information needed to be sure their curriculum is consistent with successful articulation will produce contacts with baccalaureate faculty who can provide that information and who can offer the two-year faculty whatever association is desired in the scientific and pedagogical programs of the department. Baccalaureate departments which are the most cooperative with two-year faculty may discover the fringe benefit that the better students are encouraged to go on to their institutions, too.

Professional societies must meet their responsibilities concerning important issues in mathematical education in the first two years, namely, curriculum, teaching and coordination. This conference and the joint panel on the Two-Year College Curriculum constitute a good start on the solution of this problem, which one can argue has received too little attention in recent years [12].

While Lipman Bers was President of the AMS, he encouraged research departments to allow all possible access to libraries, offices, facilities, speakers, and so on to mathematicians at nearby non-research institutions. (Cf. [13].) We would urge that this suggestion be interpreted and implemented in the broadest practical sense with respect to both the mathematical and curricular concerns of two-year college faculty.

NOTES AND REFERENCES

[1] In 1983 the Committee on the Undergraduate Program in Mathematics and the Committee on Two-Year Colleges of the MAA and AMATYC formed this Panel. Chaired by Ronald M. Davis, it is studying global curricular questions and can be viewed as a two-year college analogue of the CUPM Panel chaired by Alan Tucker which produced *Recommendations for a General Mathematical Sciences Program*, MAA, 1981.

[2] Junior College Task Force of Illinois Section, M.A.A., *Curriculum Guide for Baccalaureate Oriented Courses in Mathematics*, April 1982.

[3] D. W. Bushaw, Panel Chairman, Minimal mathematical competencies for college graduates, Amer. Math. Monthly 89 (1982) 266-272; available from the M.A.A. in reprint form.

[4] J. A. Goldstein, Panel Chairman, Mathematics appreciation courses, Amer. Math. Monthly 90(1983) 44-51 and 611-20; available from the M.A.A. in reprint form.

[5] Letter from S. P. Gordon to R. M. Davis, dated 21 October, 1983.

[6] J. T. Fey, D. J. Albers and W. F. Fleming, *Undergraduate Mathematical Sciences in Universities, Four-Year Colleges, and Two-Year Colleges*, 1980-81, C.B.M.S. (1981) 110 pp.

[7] B. A. Case and D. R. Lichtenberg, Regional meetings within the Florida Section, Focus, to appear.

[8] *New Goals for Mathematical Sciences Education*, The report of a conference sponsored by the CBMS, Notices Amer. Math. Soc. 31 (1984), 260-270.

[9] These experiences involved Tallahassee Community College and the relationship with the Department of Mathematics and Computer Science and the Department of Statistics of Florida State University, 1977-1984.

[10] See [2].

[11] R. McWilliams of Florida State University to B. A. Case of Tallahassee Community College in 1977.

[12] See [1] and *Two-Year Colleges and Basic Mathematics*, Reports of the CUPM Panel on Two-Year Colleges, in A Compendium of CUPM Recommendations, Vol. I, MAA, Washington, D. C. (1969, 1971), 203-367. Included is: A transfer curriculum in mathematics for two-year colleges (1969), 205-255.

[13] L. Bers, Letter to the Editor in Notices Amer. Math. Soc. 23 (1976), 216.

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